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GB 2176217 A EP 0722023 A2 EP 0445866 A2  
EP 0436868 A2 US 4707959 A

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(54) Abstract Title  
**Curtain wall with slidably engaging mullions and transoms**

(57) A curtain wall framework (fig 1, not shown) has a number of structural elements, preferably transoms (140) and mullions (130) that are slidably connectable to form the framework, where preferably the structural elements are perpendicular to one another. A recess (151) can be present on the transom (140) and may be in the form of a detachable bracket (150) for attachment to a key-way projection (135) on the mullion (130). The key-way projection (135) may be detachable and located on the spine (131) of the mullion (130).

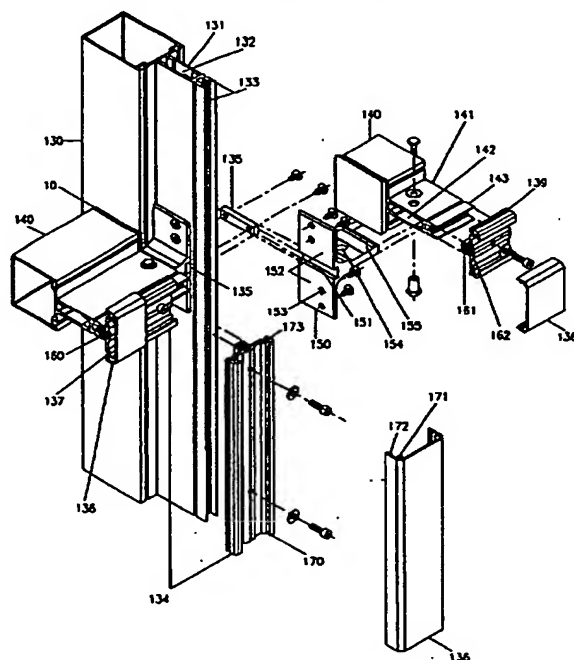


FIG. 2

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy. The claims were filed later than the filing date but within the period prescribed by Rule 25(1) of the Patents Rules 1995. This print incorporates corrections made under Section 117(1) of the Patents Act 1977.

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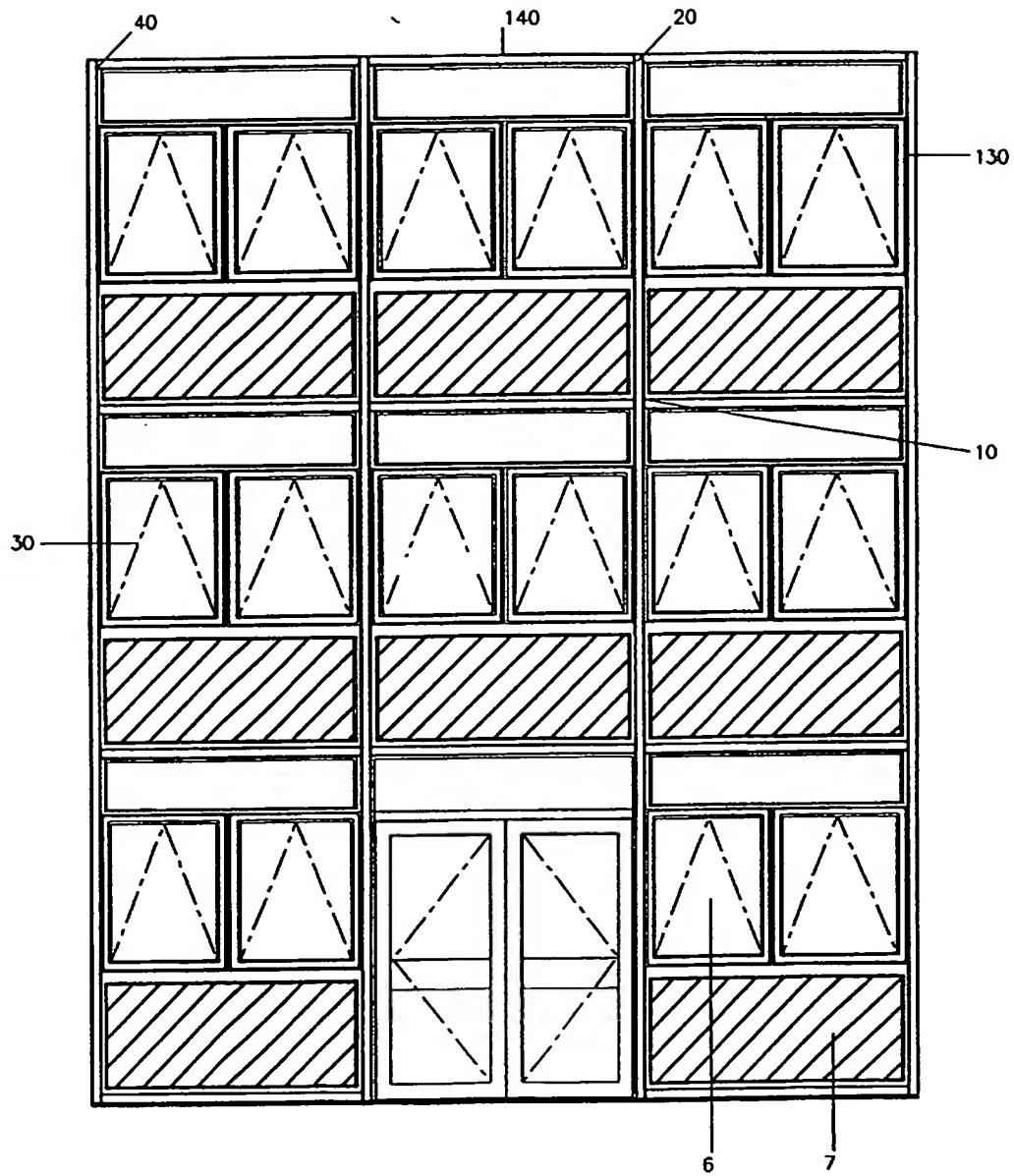


FIG. 1

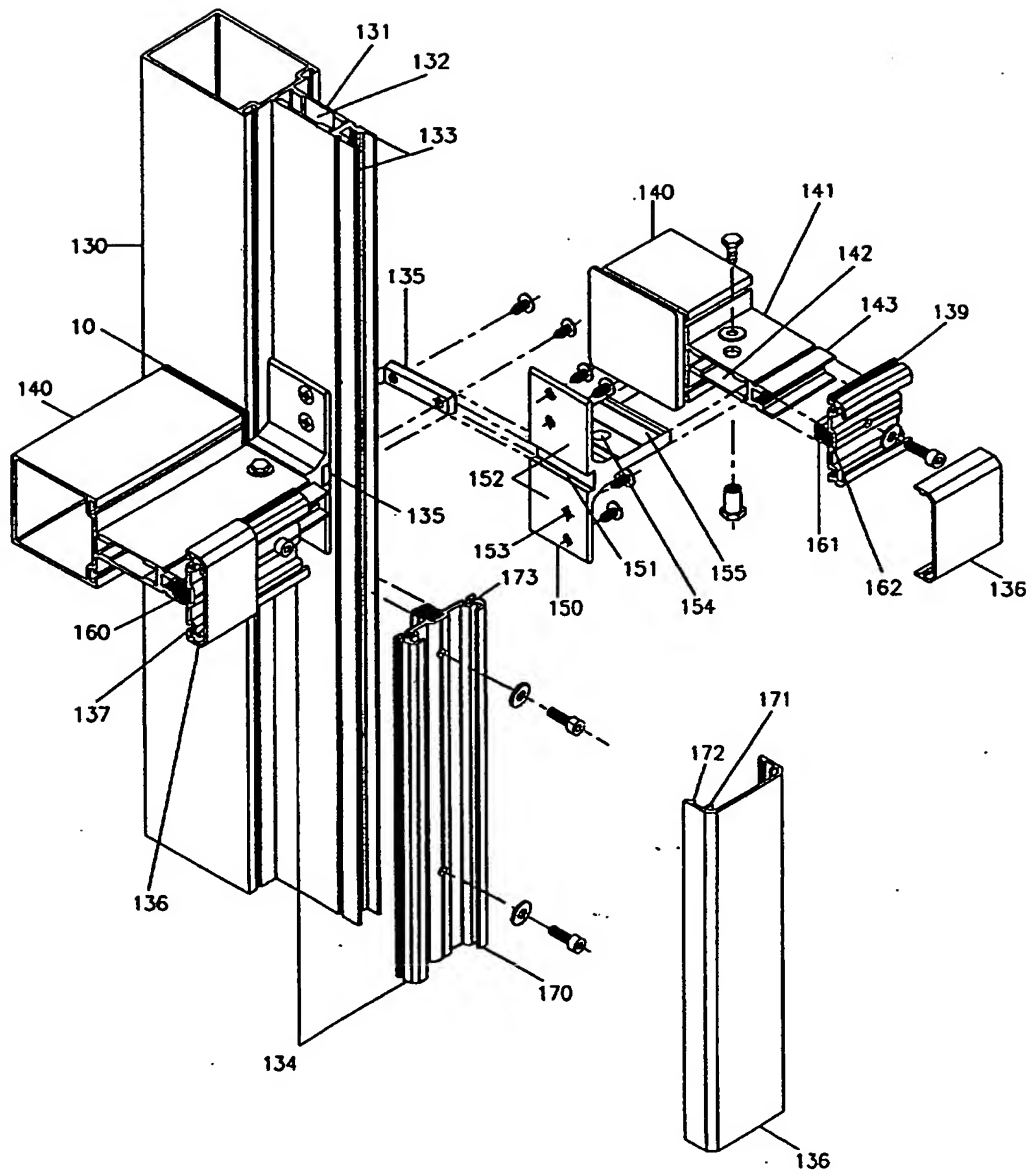


FIG. 2

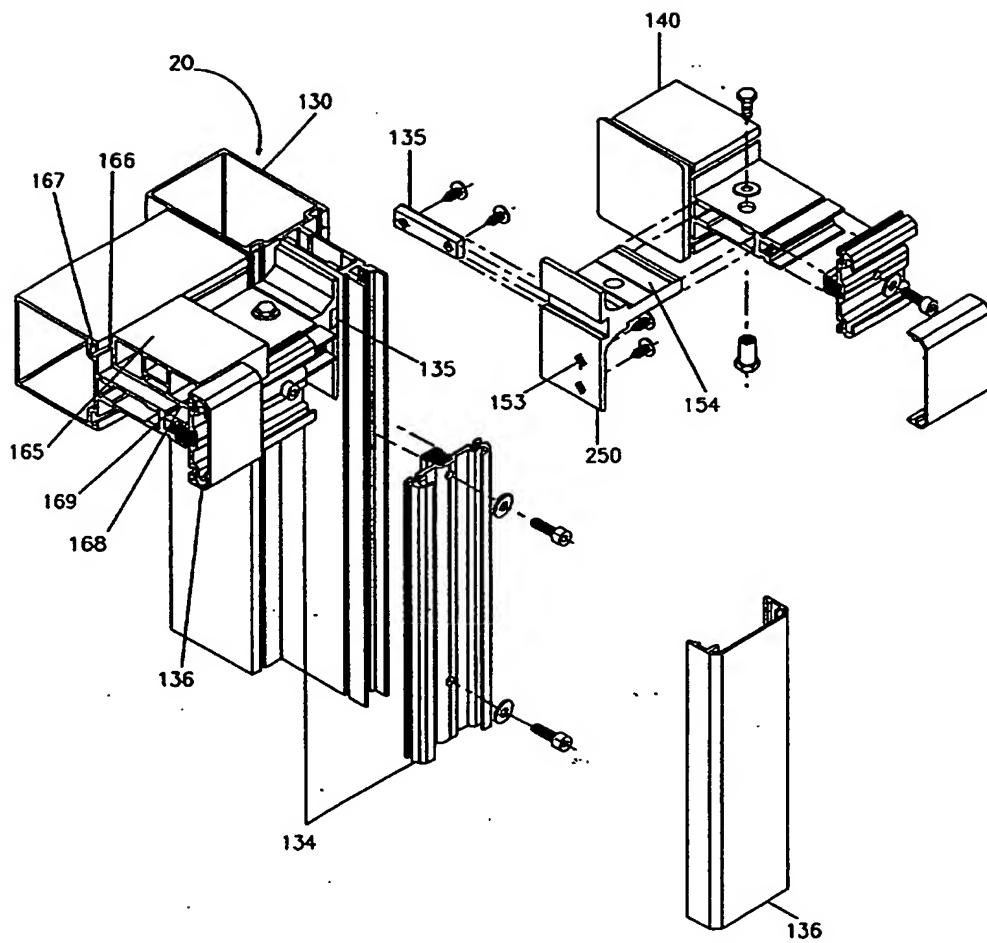


FIG. 3

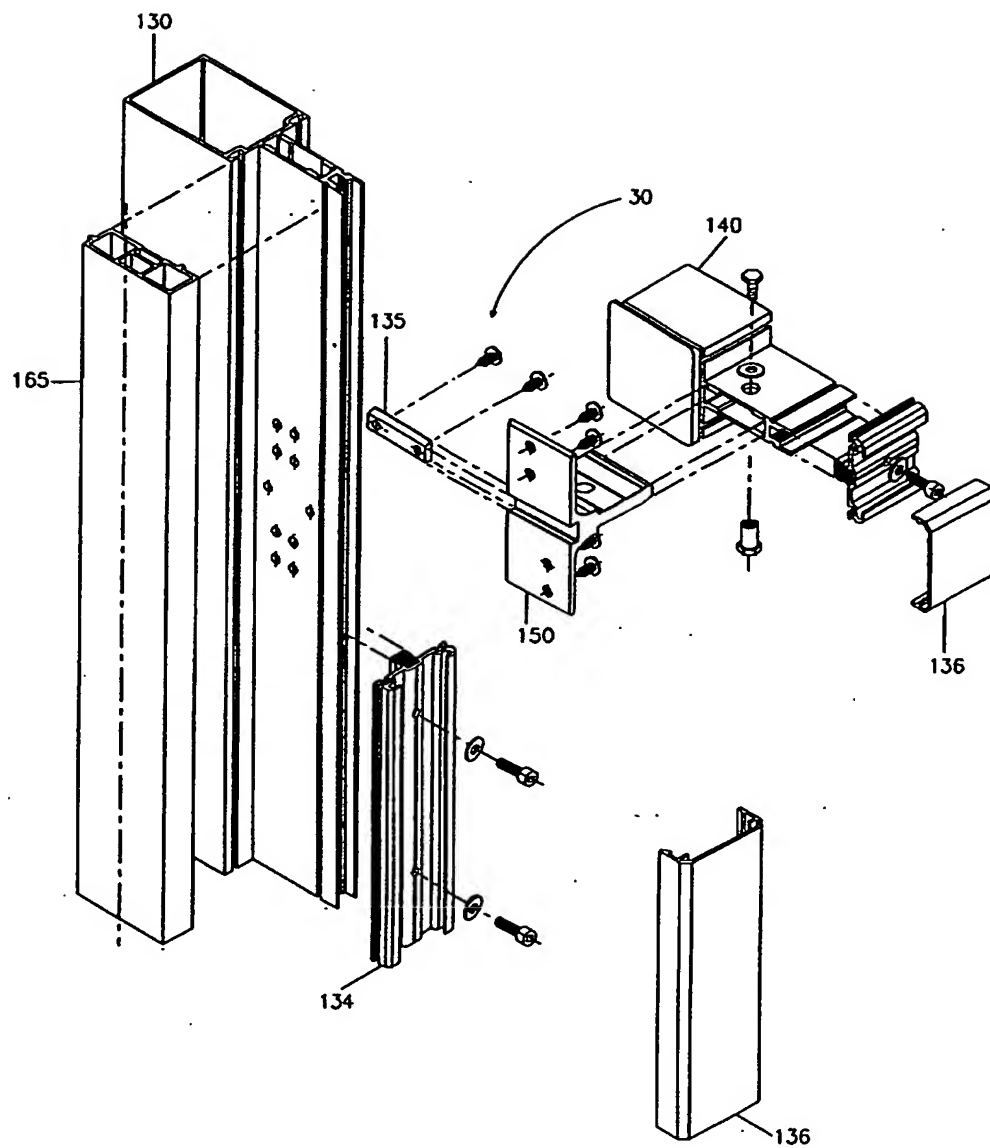


FIG. 4

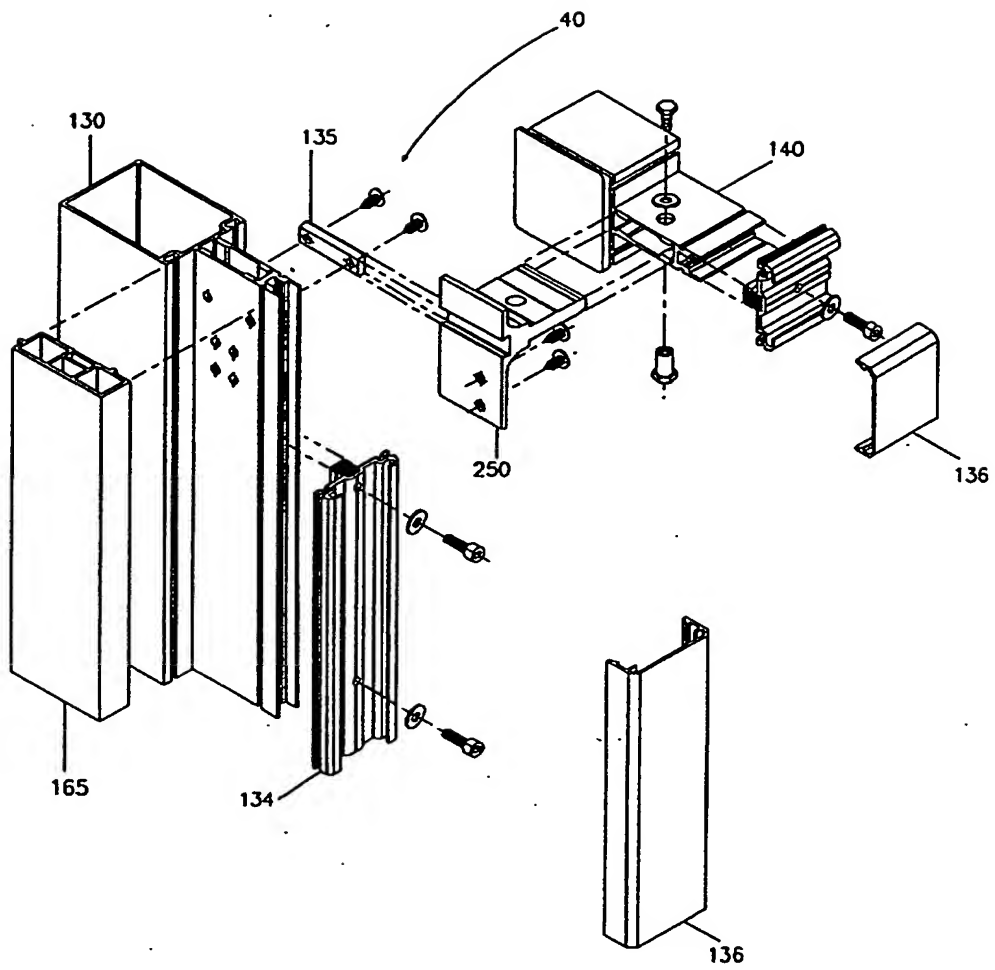


FIG. 5

## CURTAIN WALL

The present invention relates to a curtain wall system of the open framework type, and in particular to a method and means for connecting a curtain wall transom to a curtain wall mullion.

Framework curtain wall systems are conventionally of a modular construction, with vertical structural elements or mullions connected to horizontally extending structural elements or transoms to form a framework.

Conventional methods used in achieving a mullion / transom connection in curtain wall facades utilise an outwardly projecting spigot or transom block which is fitted into a recess provided by the inside face of the structural tube of the mullion. When fixed in position with screws, the spigot offers a male connection for the female end of the transom. However, this arrangement can be cumbersome and slow to assemble on site. Also, the joint must be sealed to be watertight since the assembly forms the last internal seal of the curtain wall and is therefore a potential site of water penetration into the building. A further disadvantage of this type of system is the large number of different components required. Most curtain walls of this conventional construction comprise as many as 6 or 8 differently sized spigots or blocks.

To produce a structure which can withstand a range of environmental circumstances, it is desirable that the transom / mullion connection is achieved in a manner which limits the degree to which the inner and outer seals of the

curtain wall are compromised to prevent water penetration without the need for unsightly, visual sealants.

It is desirable to provide a curtain wall which will perform in even the most adverse weather conditions without  
5 water leakage or wind penetration into the building, such as that caused by low integrity of the seals or by movement of any of the component parts of the wall due to low rigidity of the joints.

To this end, transom / mullion connection systems have  
10 been developed for framework curtain wall constructions in which a mounting projection / recess arrangement is provided on the spine of the mullion instead of on the box. In this way, the joint is located between the inner and outer seals of the curtain wall and is therefore no longer  
15 in a vulnerable area. Such constructions offer some advantage in relation to water penetration. However such constructions remain generally cumbersome and slow to assemble on site.

It is generally desirable for a connection method and  
20 means between a curtain wall mullion and transom in a framework curtain wall system to be quickly and easily assemblable to facilitate construction of the curtain wall. It is also desirable that the assembly comprises the minimum number of different components. In particular, it  
25 is desirable to facilitate ease of construction so that as much of the assembling as possible may be performed plumb on site.



It is an object of the present invention to provide a method and means of connecting the structural elements of a curtain wall framework such as a curtain wall transom and a curtain wall mullion, which is easily assemblable and  
5 limits susceptibility to water leakage, whilst providing a joint of good strength.

Thus, according to a first aspect of the invention, a structural element for a curtain wall framework comprises an elongate member provided with a recessed portion adapted  
10 to be slidably engageable with a projecting portion of a second structural element of a curtain wall framework, whereby a framework may be constructed comprising a plurality of said first and second structural elements.

Correspondingly, according to the second aspect of the  
15 invention, a structural element for a curtain wall framework comprises an elongate member provided with a projecting portion adapted to be slidably engageable with a recessed portion of a second structural element of a curtain wall framework, whereby a framework may be  
20 constructed comprising a plurality of said first and second structural elements.

In accordance with a third aspect of the invention, a curtain wall system comprises at least one of each of the first and second structural elements above described,  
25 adapted to be slidably engagable together to form a structural framework.

The arrangement of the invention thus provides for a key-way connection between the structural elements such as

the transom and mullion. This allows for a framework to be assembled by lateral sliding engagement of the structural elements (that is, by sliding engagement from outside the plane of the framework along a direction generally perpendicular to the plane of the framework) for example from the front, and facilitates ready and rapid assembly on site. In particular, the system allows for all the mullions to be assembled on site as one operation into an entire preliminary structure. The transoms may then be slid into the vertical grid provided by the mullions from the front. Even the final set of transoms can be slid into position in this way. This system can offer significant advantages over systems requiring the building of the framework piecemeal, in which the last set of transoms must be somehow "sprung" into engagement on the spigots.

Preferably the first and second structural elements are configured in use in an assembled framework to lie substantially perpendicular to each other. Preferably, the structural elements comprise a curtain wall transom and a curtain wall mullion. Preferably, the recess is provided in the curtain wall transom, and the projecting element configured to slidably engage therewith is provided in the curtain wall mullion.

In a preferred arrangement, key-way projections extend laterally along the sides of a mullion, and co-operating key-way recesses are provided at the ends of a transom to enable sliding engagement therebetween.

For ease of assembly, in a preferred arrangement the key-way projection comprises a detachable element engagable upon the mullion, and the recessed portion similarly comprises a detachable bracket engagable upon the transom.

5 This arrangement facilitates rapid on-site assembly of the respective components.

Thus, according to this preferred aspect of the invention, a curtain wall system comprises at least one mullion, at least one transom, a key-way projection  
10 detachably securable to the mullion so as to extend laterally thereon, a bracket configured to slidably engage the key-way projection at one end thereof and to be detachably securable to a transom at another end thereof; and preferably further comprises means for rigidly,  
15 detachably securing the bracket to the mullion when engaged with the key-way and similar means for securing the transom when engaged with the bracket.

Preferably, the key-way has a dovetail configuration.

A skilled person will be familiar with the usual  
20 cross-sectional structure of a typical mullion and transom for a framework curtain wall, in which an elongate structural tube of the mullion, which is generally designed to sit internally to the building, and an elongate pressure plate which is generally designed to sit externally, are  
25 connected by a spine element, so that the whole has a generally "I" - shaped cross-section. In such an arrangement, the spine lies between the internal and external seals of the framework. Conveniently therefore,

the key-way assembly is configured for location at the spine of the mullion.

In accordance with such an arrangement, the transom / mullion connection is achieved in a manner which does not  
5 prejudice the internal and external water seals already present, there is no requirement for complex and potentially unsightly further sealing arrangements, and the joint, since it is located between the inner and outer seals of the curtain wall and within the area of the built-  
10 in drainage system of the curtain wall, is no longer in a vulnerable area and no longer a potential site of water penetration.

A curtain wall system in accordance with this embodiment of the present invention thus provides for rapid  
15 and ready assembling on site, whilst at the same time providing a joint which retains good weather proofing. The system is virtually sealant free, relying upon internal and external seals and drainage to keep water and wind out of the building. The system offers the potential for good  
20 acoustic insulation when used with sealed units.

In the preferred embodiment the key-way assembly is connected to the spine of the mullion instead of the structural box. Since the spine dimension is generally the same regardless of the size of the box mullion, the key-way  
25 assembly is a one-off sized part. The number of components required in the system is reduced. This contrasts with conventional curtain wall systems which may well have as many as six or eight spigots or blocks of different sizes.

According to a further aspect of the present invention, a method of assembly of a curtain wall system comprises:-

providing a plurality of structural elements for a  
5 curtain wall framework, each comprising an elongate member;  
providing a first set of said structural elements with  
recessed portions, and providing a second set of said  
structural elements with projecting portions, the  
projecting portions and the recessed portions being co-  
10 operably adapted to be slidably engageable; slidably  
engaging at least one of said first set of structural  
elements with at least one of said second set of structural  
elements so as to form a framework of said structural  
elements.

15 The first and second structural elements are  
preferably configured to lie substantially perpendicular to  
each other in the constructed framework, and are  
conveniently curtain wall transoms and mullions, and the  
method is therefore preferably a method for assembling a  
20 curtain wall framework from curtain wall transoms and  
mullions. In accordance with the foregoing method, ready  
and rapid assembly of a framework is enabled. In  
particular, a framework comprising the mullions can be  
assembled on site and the transoms subsequently slidably  
25 engaged with this framework from the front.

In accordance with a preferred embodiment of the  
method, the projections are provided by attachment of a  
detachable projection means, and the recesses are provided

by attachment of detachable recess means. Preferably, the projections are attached laterally upon a mullion, and the co-operating recesses comprise brackets attached to an end of a transom.

5 Further features of the method will be understood by analogy with the preferred features described for the structural elements above.

By way of example, the invention will be described with reference to the accompanying drawings, of which:

10 Figure 1 is a front elevation of a curtain wall construction;

Figure 2 is an exploded isometric view of a transom / mullion cruciform joint in accordance with the present invention;

15 Figure 3 is an exploded isometric view of a transom / mullion top "T" joint in accordance with the present invention;

Figure 4 is an exploded isometric view of an intermediate transom / mullion "end" joint in accordance  
20 with the present invention;

Figure 5 is an exploded isometric view of a transom / mullion top "end" joint in accordance with the present invention.

Referring to the drawings, figure 1 shows a curtain  
25 wall 1 embodying the transom / mullion connection means in accordance with the present invention. The curtain wall includes mullions 130; transoms 140 releasably secured thereto; and windows 6 and panels 7 releasably secured

therebetween. Furthermore, the curtain wall includes a transom / mullion cruciform joint 10; a transom / mullion top "T" joint 20; a transom / mullion "end" joint 30; and a transom / mullion top "end" joint 40, each type of joint  
5 being shown in more detail in figures 2; 3; 4 and 5 respectively.

Referring to figure 2 in more detail, the substantially vertical mullion 130 is configured to have a box of substantially hollow square cross-section with a  
10 spine 131 extending from one side thereof. The spine 131 comprises a hollow 132 and two projections 133, the projections 133 being adapted to receive the pressure plate 134 which is described in more detail below.

Holes (not shown) are provided in the spine 131 of the  
15 mullion 130 for releasably securing the key-way projection 135 thereto. The key-way 135 is positioned so that its longest length has a substantially horizontal attitude extending laterally along a side of the mullion. The key-way 135 provides a projection extending perpendicularly to  
20 the spine 131. The key-way may be secured in place using self tapping screws. The key-way 135 is preferably configured with a dovetail cross-section.

A recess 151 in bracket 150 is adapted to slidably receive and engage the key-way projection 135. The bracket  
25 150 comprises flanges 152 adapted to lie adjacent the spine 131 when the bracket 150 is engaged with the key-way 135. Holes 153 are provided in the flanges 152 to correspond with similar holes (not shown) in the spine 131. The

bracket 150 is releasably secured to the spine 131 of the mullion 130 using screws, such as stainless steel self tapping screws.

5 The bracket 150 also comprises a projection 154 extending substantially perpendicularly from the flanges 152, and therefore similarly extending in relation to the mullion 130. The projection 154 includes a hole 155 through which it can be secured in place on the transom as described below.

10 The projection 154 from the bracket 150 is adapted to slidably receive and engage the hollow 142 in the spine 141 of the transom 140. The transom 140 is then releasably secured to the bracket 150 by passing a suitable fastening means, such as a hexagon head set pin through the hole 155.  
15 It should be noted that the transom 140 and the mullion 130 have the same cross-section.

Projections 143 are provided on the transom 140 which correspond to the projections 133 on the mullion 130. These projections are adapted to receive the C-section 161  
20 which is configured so as to partially envelope the seal 160.

A pressure plate 134 is configured to engage the opposite side of the seal 160 by means of a C-shaped recess 162 therein, similar to the recess formed by the C-section  
25 161. Fastening means are used to releasably secure the pressure plate assembly to the mullion 130 or the transom 140, such as stainless steel cap screws.



The pressure plate 134 is generally a C-section, with the C-shaped recess 162 disposed centrally therein but inverted. Passages 137, again generally C-shaped, are provided in the sides of the pressure plate with openings  
5 in the same orientation as that of passage 162. The passages 137 are adapted to receive seals (not shown). The pressure plate further includes a recess 139 in the sides thereof. Inwardly oriented protrusions 170 are provided substantially perpendicular to the sides of the pressure  
10 plate 134.

The cover plate 136 is adapted to clip over the pressure plate 134 for ease of attachment. The cover plate 136 is of a generally U shaped cross-section with a protrusion 171 extending inwardly and perpendicular to the  
15 sides of the cover plate 136. A further protrusion 172 is located also on the side of the cover plate 136. The protrusion 172 is angled to allow the cover plate 136 to be engaged in position with the pressure plate 134 in conjunction with the angled surface 173 of the pressure  
20 plate. The cover plate is then held in place by the protrusions 171 and 172 of the cover plate and by the protrusion 170 and angled protrusion 173 of the pressure plate. This arrangement enables rapid, snap-fit type attachment of the cover plate and ensures a good fit.

25 Figure 3 shows the connection means adapted to be positioned at the top end of a mullion. To avoid confusion, like parts have been indicated with like reference numerals.

Figure 3 shows a mullion 130 with key-way projections 135 located towards the upper end thereof, with a substantially horizontal orientation. Bracket 250 is similar to the bracket 150 of figure 2 with the upper flange having been altered to allow the projection 154 to be positioned closer to the upper extremity of the mullion 130. This has made it necessary to remove the holes 153 in the upper flange of bracket 250. Again, the bracket provides a key-way recess adapted for sliding engagement with the dovetail projection 135.

The components and method of assembly of this joint are otherwise identical to that of joint 10, apart from the addition of pocket filler 165, having a substantially hollow rectangular cross-section. Pocket filler 165 is configured with a protrusion 166 being substantially horizontal and running along the side rear edge of the pocket filler 165, and with a similar protrusion 168 running along the bottom of the pocket filler 165, towards the front edge. Recess 167 and groove 169 are adapted to slidably receive the pocket filler 165, thereby putting the lower surface of the pocket filler 165 in contact with an exposed upper surface of the seal 160.

Figure 4 shows the joint of figure 2 adapted to be positioned at the side of the curtain wall framework. Like parts have been indicated with like references. It should be noted that the joint 30 is identical to each of the joints either side of the mullion 130 shown in figure 2. However, a pocket filler 165 has been added to the outer

side of the mullion in an identical manner to that of Figure 3.

Figure 5 shows the joint adapted to be positioned in one of the corners of the framework for a curtain wall, in this case the top left hand corner. This connection uses the bracket 250, with the truncated upper flange, to enable it to be positioned as close as possible to the upper extremity of the mullion. Pocket filler 165 is provided for the outside edge of the mullion, a similar one also being provided for the upper surface of the transom, but not shown in this drawing.

It will be apparent that where a joint is shown to be positioned at a top end of a mullion or on one side thereof, an identical joint can be formed at the lower end or other side respectively, simply by inverting the representation.

It will be understood that the configurations of the parts shown in the drawings are by way of example only and should not be seen to limit the scope of the invention to the embodiments shown. In particular, the skilled man will be aware of many changes that can be made to the structural elements in accordance with known examples of mullion and transom without departing from the underlying principle of the invention in the use of a sliding key-way arrangement to effect assembly of the framework.

## CLAIMS

1. A curtain wall system comprising at least one first structural element for a curtain wall framework, the  
5 element comprising an elongate member provided with a recessed portion adapted to be slidably engageable with a projecting portion of a second structural element of a curtain wall framework, whereby a framework may be constructed comprising a plurality of said first and second  
10 structural elements.

2. A curtain wall system comprising at least one second structural element for a curtain wall framework, the element comprising an elongate member provided with a projecting portion adapted to be slidably engageable with  
15 a recessed portion of a first structural element of a curtain wall framework, whereby a framework may be constructed comprising a plurality of said first and second structural elements.

3. A curtain wall system comprising at least one of  
20 the first structural elements in accordance with claim 1 and at least one of the second structural elements in accordance with claim 2 adapted to be slidably engageable together to form a structural framework.

4. A system in accordance with any preceding claim  
25 wherein the first and second structural elements are configured in use in an assembled framework to lie substantially perpendicular to each other.

5. A system in accordance with claim 4 wherein the first and second structural elements comprise a curtain wall transom and a curtain wall mullion.

6. A system in accordance with claim 5 wherein the recess is provided in the curtain wall transom, and the projecting element configured to slidably engage therewith is provided in the curtain wall mullion.

7. A system in accordance with claim 6 wherein key-way projections extend laterally along the sides of a mullion, and co-operating key-way recesses are provided at the ends of a transom to enable sliding engagement therebetween.

8. A system in accordance with claim 7 wherein the key-way projection comprises a detachable element engagable upon the mullion, and the recessed portion similarly comprises a detachable bracket engagable upon the transom.

9. A system in accordance with claim 7 or 8 wherein the key-way has a dovetail configuration.

10. A system in accordance with any one of claims 7 to 9 wherein the key-way assembly is configured for location at the spine of the mullion.

11. A method of assembly of a curtain wall system comprising:-

providing a plurality of structural elements for a curtain wall framework, each comprising an elongate member;

providing a first set of said structural elements with recessed portions, and providing a second set of said structural elements with projecting portions, the  
5 projecting portions and the recessed portions being co-operably adapted to be slidably engageable;

slidably engaging at least one of said first set of structural elements with at least one of said second set of  
10 structural elements so as to form a framework of said structural elements.

12. The method of claim 11 wherein the first and second structural elements are configured to lie substantially perpendicular to each other in the  
15 constructed framework.

13. The method of claim 12 wherein the first and second elements are respectively curtain wall transoms and mullions, and the method is a method for assembling a curtain wall framework from curtain wall transoms and  
20 mullions.

14. The method of one of claims 11 to 13 wherein projections are provided by attachment of detachable projection means, and recesses are provided by attachment of detachable recess means.

25 15. The method of claim 14 wherein the projections are attached laterally upon a mullion, and the co-operating recesses comprise brackets attached to an end of a transom.

16. A curtain wall system substantially as  
hereinbefore described with reference to the accompanying  
5 drawings.

17. A method of assembly of a curtain wall system  
substantially as hereinbefore described with reference to  
the accompanying drawings.

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Application No: GB 9910661.9  
Claims searched: 1-17

18  
Examiner: Lyndon Ellis  
Date of search: 27 March 2000

## Patents Act 1977 Search Report under Section 17

### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): E1D DLEKMNV, DLEKMNW, DLEKMSV, DLEKMSW

Int Cl (Ed.7): E04B

Other: Online: EPODOC, WPI, JAPIO

### Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2176217 (James Alan Macey) Whole document, especially fig 5.	1-8 and 11-15
X	EP 0722023 A2 (Schuco International KG) Whole document, especially slide (6) and chamber (12), fig 2.	1-7 and 11-13
X	EP 0445866 A2 (Hydro Alluminio Ornago S.P.A.) Whole document.	1-7 and 11-13
X	EP 0436868 A2 (Reynolds Aluminium) Whole document, especially fig1.	1-7 and 10-13
X	US 4707959 (Richard L. Stoakes) Whole document, especially column 3, lines 54-55.	1-7 and 11-13

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.